

Antimicrobial Stewardship

Rand Sulaiman, PharmD, BCIDP
Infectious Diseases Pharmacy Specialist
Ascension Genesys Hospital
Grand Blanc, Michigan

“Microbes are educated to resist penicillin and a host of penicillin-fast organisms is bred out... In such cases, the thoughtless person playing with penicillin is morally responsible for the death of the man who finally succumbs to infection with the penicillin-resistant organism.

I hope this evil can be averted.”

Alexander Fleming



Antimicrobial Good News/Bad News

GOOD NEWS

Antibiotics have transformed the practice of medicine, making once lethal infections readily treatable

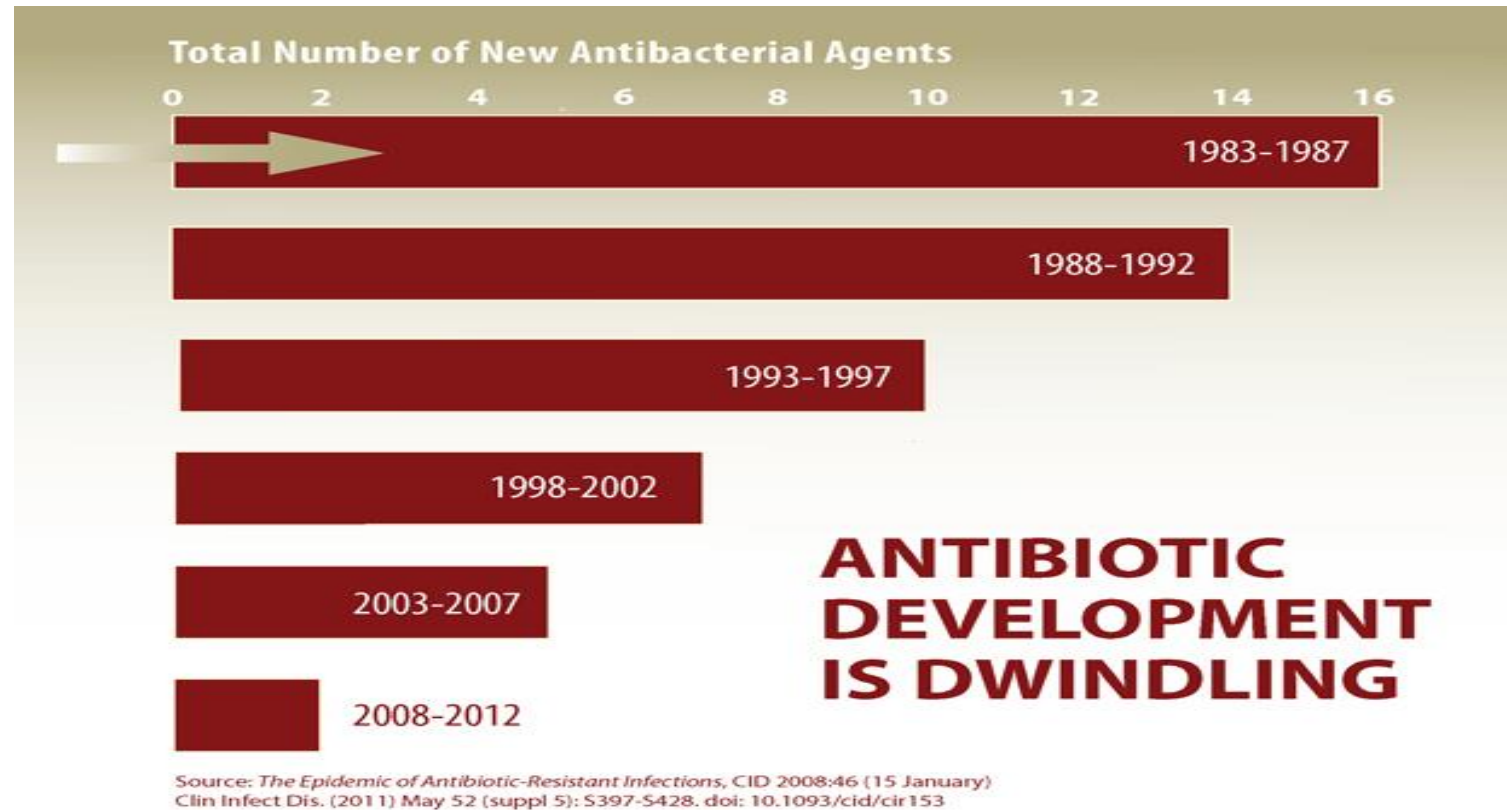
20-50% of all antibiotics prescribed in U.S. acute care hospitals are either unnecessary or inappropriate

BAD NEWS

So.... what's the problem

- Serious side effects/ adverse events
- Antibiotic resistance
- Estimated >2 million people are infected with antibiotic-resistant organisms contributing to approximately 23,000 deaths annually

History of Antibiotic Discovery



What is Antimicrobial Stewardship?

- ▶ The **optimal selection, dosage, & duration** of antimicrobials that results in:

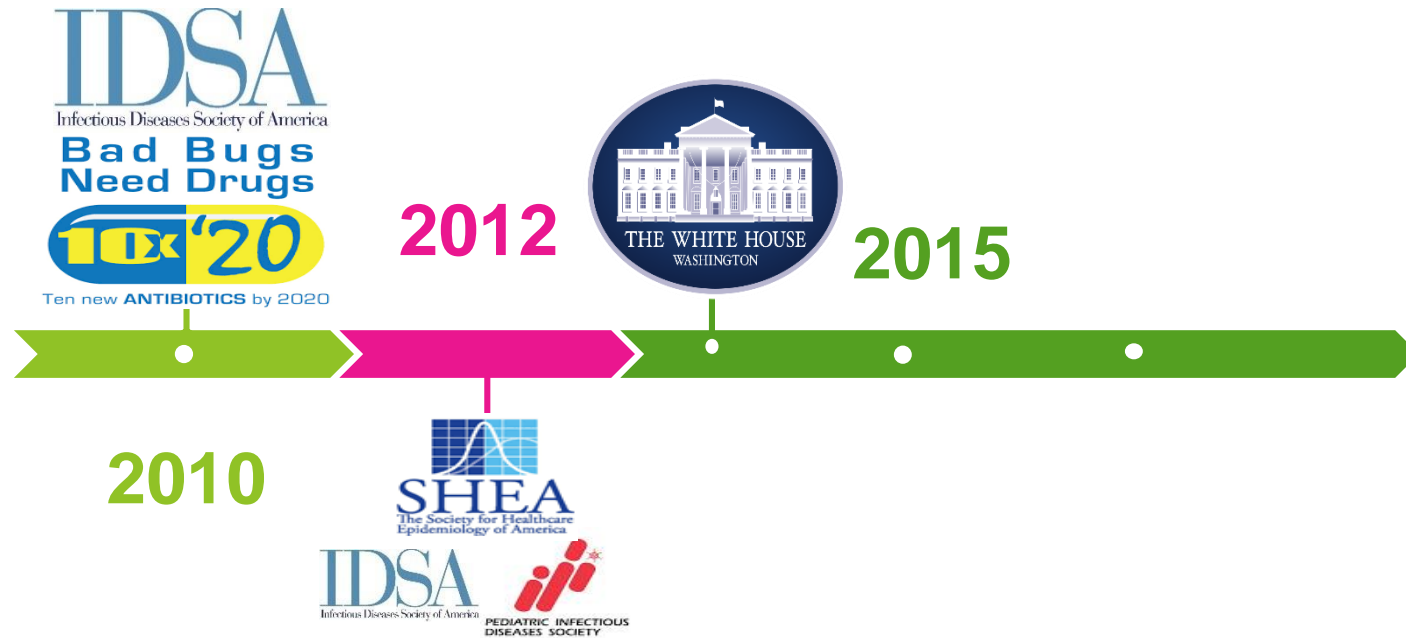


Optimize patient safety

Ensure optimal use of antimicrobials

Minimize unintended consequence
(e.g drug resistance, toxicity)

Antimicrobial Stewardship Timeline



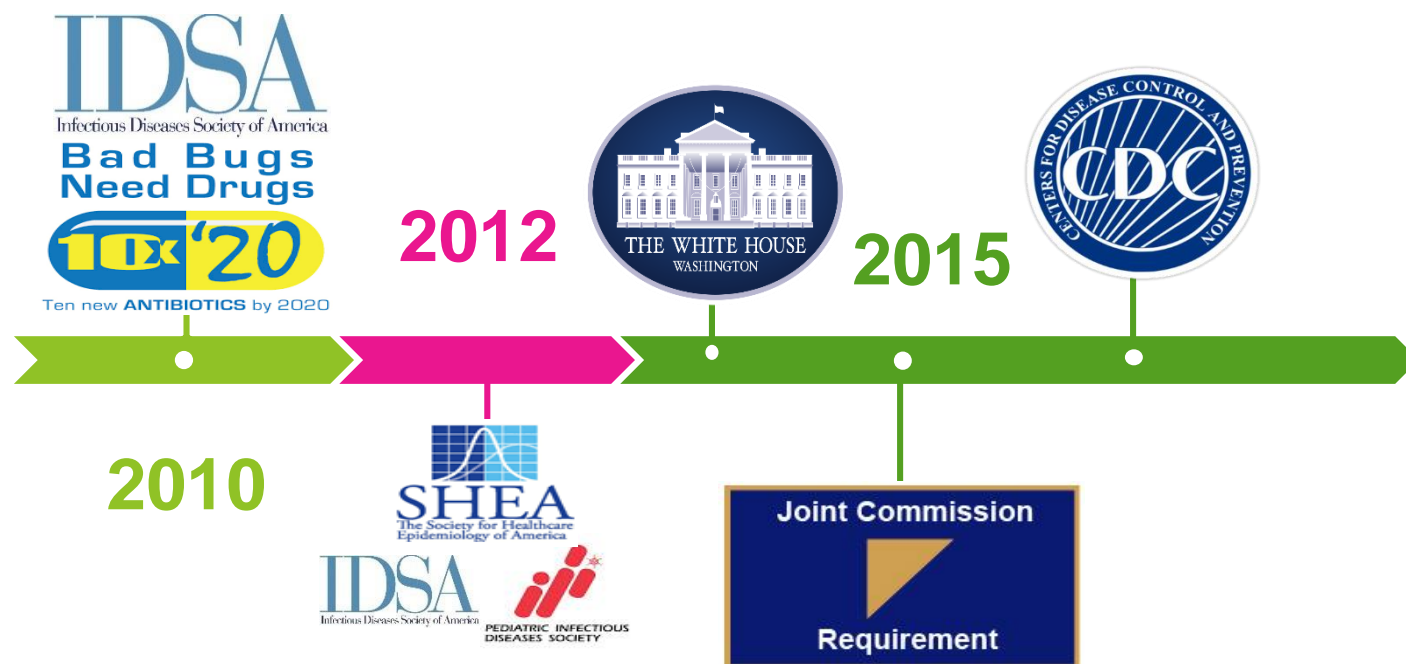
Forum on Antibiotic Stewardship

National Action Plan for Combating Antibiotic-Resistant Bacteria to achieve 5 core goals within the next 5 years:

- ❑ Slow the emergence and prevent the spread of resistant bacteria
- ❑ Strengthen surveillance efforts to combat resistance
- ❑ Advance development of rapid and innovative diagnostic tests to identify resistant bacteria
- ❑ Accelerate research and development for new antibiotics
- ❑ Improve international collaboration



Antimicrobial Stewardship Timeline



Antimicrobial Stewardship Standard: Hospitals

- ▶ Leaders establish antimicrobial stewardship as an organizational priority
- ▶ Medical staff education
- ▶ Multidisciplinary Antimicrobial Stewardship team
- ▶ Core elements





Antimicrobial Stewardship Core Elements

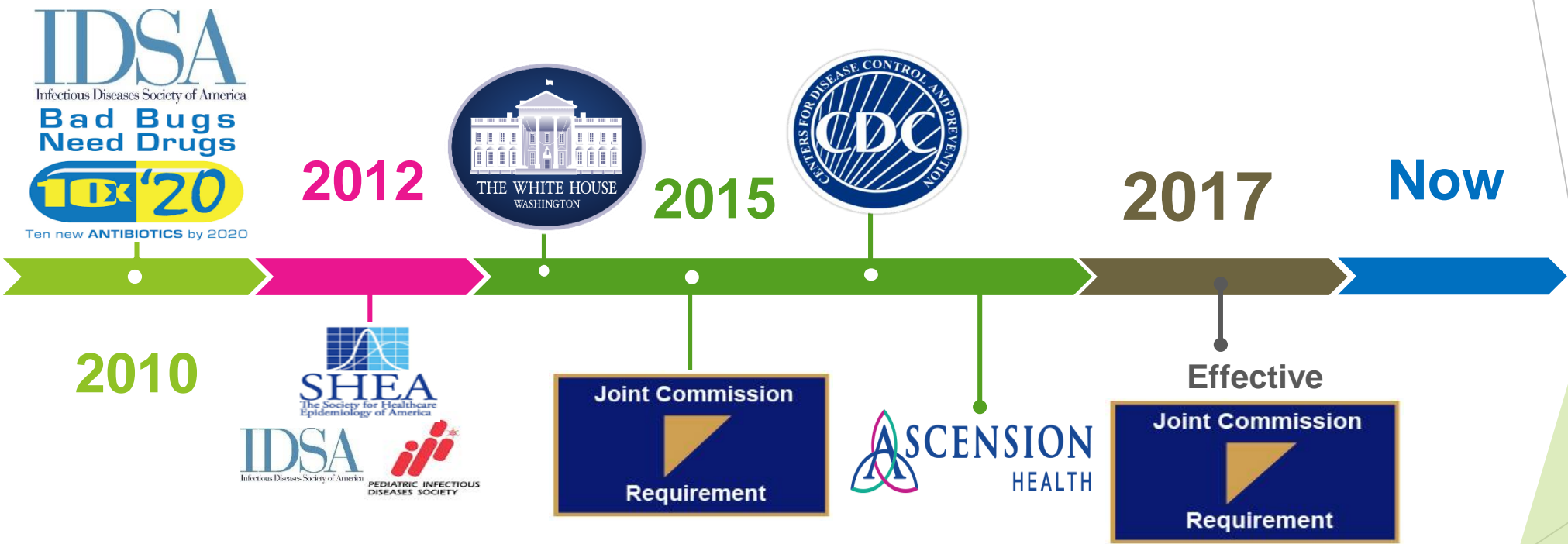


Antimicrobial Stewardship Standard: Hospitals

- ▶ Leaders establish antimicrobial stewardship as an organizational priority
- ▶ Medical staff education
- ▶ Multidisciplinary Antimicrobial Stewardship team
- ▶ Core elements
- ▶ Collect, analyze, and report data on hospital antimicrobial stewardship program
- ▶ Take action on improvement opportunities identified in its antimicrobial stewardship program

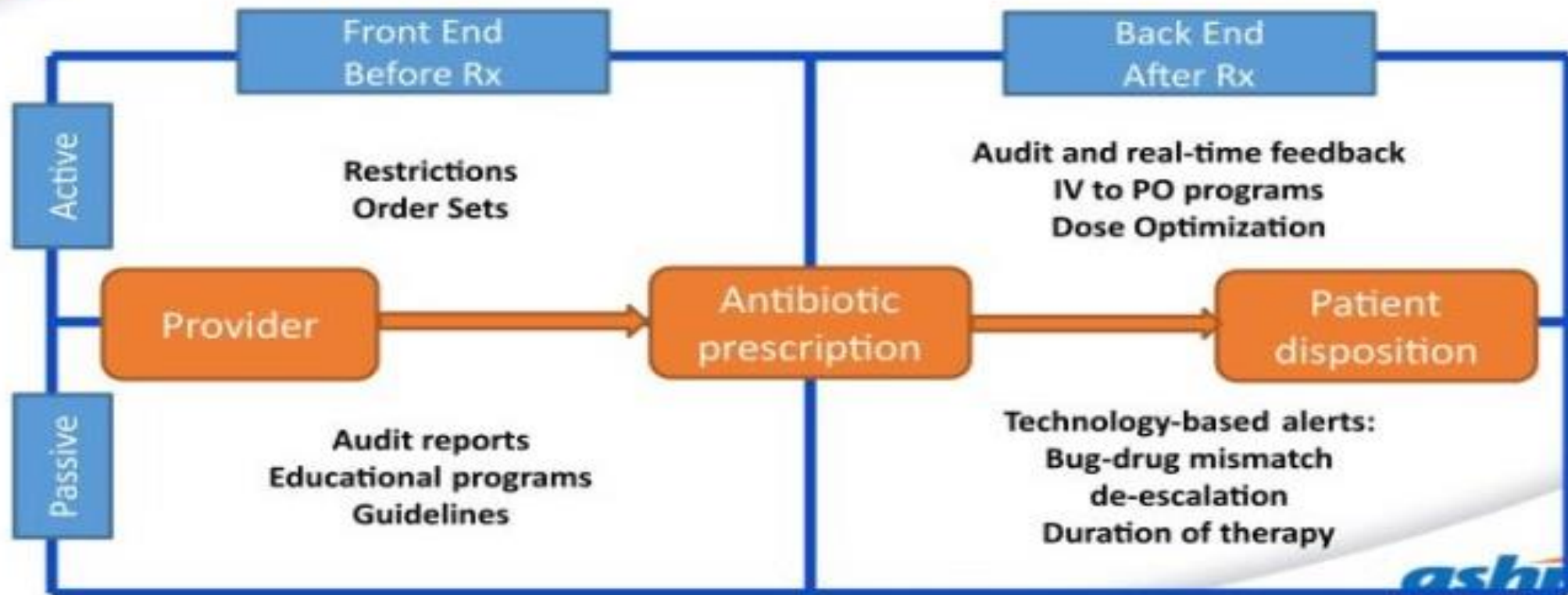


Antimicrobial Stewardship Timeline



Antimicrobial Stewardship Strategies

Stewardship Intervention Examples



Antibiogram & Order Sets

► Antibiogram

- ❖ Periodic summary of antimicrobial susceptibilities of local bacterial isolates
- ❖ Used by clinicians to assess local susceptibility rates
- ❖ Aids in selecting empiric antibiotic therapy, and in monitoring resistance trends over time
- ❖ Can also be used to compare susceptibility rates across institutions and track resistance trends
- ❖ Antibiogram is the first step towards the development of antibiotic use policies and order sets

► Order sets: common infectious diseases

- ❖ Sepsis
- ❖ Urinary tract infections
- ❖ Pneumonia
- ❖ Skin and soft tissue infections
- ❖ Others

Impact:
Increase likelihood of appropriate
antimicrobials prescribing empirically

Successful Carbapenems & Anti-MRSA Agents Restriction

- ▶ Established criteria for use and required specialist consultation
- ▶ Restrictions
 - ❖ Broad or niche antimicrobial therapy: meropenem, daptomycin, ceftaroline, etc
 - ❖ Antimicrobial therapy with toxicities: levofloxacin, colistin, etc

Successful Carbapenems & Anti-MRSA Agents Restriction



Antimicrobial Stewardship Trained Pharmacist

Dedicated time to antimicrobial stewardship

Ensuring successful implementation of initiatives

Tracking progress by conducting monthly restricted antimicrobial use evaluation

Reporting result and impact of initiatives

Educating healthcare providers (pharmacists, physicians, and nurses)

Local Leadership Support (VPMA, CMO)

- Support successful implementation of initiative
- Create accountability among prescribers

Impact of Carbapenems & Anti-MRSA Agents Restriction

- ▶ Minimize unintended consequence of resistance development to potentially inappropriately selected unnecessary broad agent
- ▶ Minimize broad spectrum antibiotics adverse events such as Clostridium difficile infection
- ▶ Optimize appropriate use
- ▶ Significant reduction in unnecessary use of restricted/protected agent

Education: Beta-lactam Cross-Reactivity

- ▶ Penicillin is the most frequently reported medication allergy
 - ❖ Up to 10% of the general population report penicillin allergy
- ▶ 80-90% of patients with reported penicillin allergy are not truly allergic
- ▶ True estimated rate of cross-reactivity between penicillins and cephalosporins is reported to be <1%
- ▶ Cross-reactivity is most likely the result of structurally similar side chain (R group) of cephalosporins and penicillins, not the β -lactam ring

**Minimal cross reactivity of the following:
Cefazolin, Cefuroxime, Ceftriaxone and Cefepime**

Education: Beta-lactam Cross-Reactivity

	Penicillins							1 st Gen Ceph.		2 nd		3 rd	4 th	
	Penicillin G/VK	Nafcillin	Oxacillin	Dicloxacillin	Amoxicillin (+/- clavulanate)	Ampicillin (+/- sulbactam)	Piperacillin/tazobactam	Cephalexin	Cefazolin	Cefoxitin	Cefprozil	Cefuroxime	Ceftriaxone	Cefepime
Penicillin G/VK														
Nafcillin														
Oxacillin														
Dicloxacillin														
Amoxicillin (+/- clavulanate)														
Ampicillin (+/- sulbactam)														
Piperacillin/tazobactam														
Cephalexin														
Cefazolin														
Cefoxitin														
Cefprozil														
Cefuroxime														
Ceftriaxone														
Cefepime														

Key	
	<p>Proceed. Unlikely to cross-react.</p> <p>Proceed as long as any reaction other than a type I IgE-mediated reaction (e.g. anaphylaxis, angioedema, urticaria) is documented. For type I IgE-mediated reactions, a β-lactam with a different side chain can be safely administered; however, the prescriber should be notified to communicate this information and confirm the order.</p>
	<p>Consider proceeding with caution.</p> <p>Limited or no data exist on cross-reactivity, these drugs do not share similar side chains but may have a theoretical concern for cross-reactivity. This should be communicated with the prescriber.</p>
	<p>Avoid if alternatives are available.</p> <p>Share similar (not identical) side chains. Unknown likelihood of cross-reactivity</p>
	<p>Do not proceed</p> <p>These agents share identical R₁ or R₂ side chains. The risk of cross-reactivity is increased</p> <p>The prescriber should be notified and a different agent should be considered</p>

Impact of Beta-lactam Allergy Education

- ▶ Increase compliance to first line agent (e.g. cefazolin) for surgical prophylaxis, and other infections
- ▶ Minimize unnecessary use of broad-spectrum agents such as Carbapenems, and agents associated with toxicities such as Fluoroquinolones
- ▶ Remove unnecessary alerts/concerns for cross reactivity among beta-lactam agents

Education & Technology Based Alerts: Asymptomatic Bacteriuria

Urinalysis/Urine Culture Ordering Algorithm

THE ISSUE

Asymptomatic bacteriuria (ASB): is common in many patient populations

Infectious Diseases Society of America (IDSA) National Guidelines:

“ASB is NOT an indication to treat”

- Inappropriate treatment does not improve outcomes however, it increases the risk of adverse events, colonization/infection with drug-resistant organisms, *Clostridium difficile* infection
- Treatment with antibiotics has been associated an 8-fold greater incidence of developing *C. difficile* in addition to subsequent colonization/infection with drug-resistant organisms, increased incidence of adverse events with no difference in mortality, time to next UTI, or number of UTIs

Education & Technology Based Alerts

When to Order Urinalysis (UA)/Urine Culture

Should this patient be evaluated for UTI?

Does the patient have any of the following *without alternate explanation*?

- Urgency, frequency, dysuria
- Suprapubic or costovertebral pain or tenderness
- Fever* $>38^{\circ}\text{C}$ or rigors without alternative cause
- New onset altered mental status (AMS)** leukocytosis ($\text{WBC} > 10 \times 10^9/\text{L}$), hypotension, ($\text{SBP} < 90\text{mmHg}$), or > 2 SIRS criteria
- Spasticity or autonomic dysreflexia in patients with spinal cord injury

YES



Order UA (infectious) (will be held/preserved in lab for 48 hours)

+/-Urine Culture (may be ordered immediately or as reflex from UA already collected and held for 48 hours)

(if catheter already in place >24 hours, replace catheter prior to obtaining fresh urine specimen)



NO





**DO NOT order
UA or Urine culture**

“UA/Reflex to Urine Culture” is no longer available

Education & Technology Based Alerts

<div>  Non-Urinary Catheter  </div> When to OBTAIN or NOT OBTAIN a Urine Specimen	
Discourage UA and Urine Culture Use	Appropriate UA (infectious) and Urine Culture Use
Urine quality: color, smell, sediments, turbidity (do not constitute signs of infection)	Part of an evaluation of sepsis without a clear source
Screening urine cultures (on admission or before non-urologic surgeries)	Based on local findings suggestive of UTI – see “Should this patient be evaluated for UTI?” box above
Asymptomatic elderly and diabetics (high prevalence of asymptomatic bacteriuria)	
Standing orders for UA/Urine culture without an appropriate indication	Prior to urologic surgeries or TURP where mucosal bleeding is anticipated
Repeat urine culture to document clearing of bacteriuria (no clinical benefit to patients)	
“PAN” culturing (mindfulness in evaluating source is key)	Early pregnancy (avoid urinary catheters if possible)
Obtaining urine cultures based on pyuria in an asymptomatic patient	

<div>  Indwelling Urinary Catheter  </div> When to OBTAIN or NOT OBTAIN a Urine Specimen	
Discourage UA and Urine Culture Use	Appropriate UA (infectious) and Urine Culture Use
Urine quality: color, smell, sediments, turbidity (do not constitute signs of infection)	Part of an evaluation of sepsis without a clear source (CAUTI is often a diagnosis by exclusion)
Screening urine cultures (on admission or before non-urologic surgeries)	Based on local findings suggestive of CAUTI (pelvic discomfort or flank pain)
Asymptomatic elderly and diabetics (high prevalence of asymptomatic bacteriuria)	
Standing orders for UA/Urine culture without an appropriate indication	Prior to urologic surgeries or TURP where mucosal bleeding is anticipated
Repeat urine culture to document clearing of bacteriuria (no clinical benefit to patients)	
“PAN” culturing (mindfulness in evaluating source is key)	Early pregnancy
Obtaining urine cultures based on pyuria in an asymptomatic patient	

Impact (*expected*) of Education and Alerts: Asymptomatic Bacteriuria

- ▶ Reduce unnecessary treatment of asymptomatic bacteriuria and minimize exposure to unnecessary antimicrobials
- ▶ Reduce unnecessary laboratory collection, and processing

Audit & Real-time Feedback/De-escalation: Vancomycin

► Vancomycin Timeout

- ❖ De-escalation checklist: pharmacist-led assessment for opportunities to de-escalate therapy at day #3 of therapy and daily thereafter or discuss an appropriate duration (stop date)

Vancomycin Timeout Checklist at 72 Hours

Does the patient have a bacterial infection or is an alternative diagnosis the more likely cause of symptoms?

- Is the diagnosis still related to bacterial infection?
- If a bacterial infection has been ruled in, update the indication to clarify the source of infection (e.g. community acquired pneumonia, diabetic foot infection, meningitis).
- If the patient's symptoms are most likely from noninfectious causes (e.g heart failure), contact the provider to consider stopping antibiotics.

Assess vitals, labs, and other clinical data pertinent to the patient's infection

- Assess the patient's response to antibiotics by monitoring WBC, temperature, respiratory rate, heart rate, blood pressure, O₂ status or ventilator requirements, and vasopressor requirements. If the patient is clinically improving, proceed to the section below regarding de-escalation.
- If procalcitonin is ≤ 0.25 µg/L and the patient is being treated for a lower respiratory tract infection, discuss stopping antibiotics with the provider.

Does the patient have pneumonia with a negative nasal MRSA PCR swab or Respiratory culture: Commensal Flora. No MRSA No Pseudomonas Isolated?

- If Respiratory culture: Commensal flora. No MRSA No Pseudomonas Isolated. And pt is clinically improving consider recommending discontinuing vancomycin
- If the MRSA nasal PCR swab is negative and no exclusion criteria are met, contact the provider to recommend discontinuing vancomycin (NPV >98%).

When should I consider continuing vancomycin?

- If culture results are positive for MRSA or ampicillin-resistant enterococcus recommend to continue vancomycin if intravenous therapy is still warranted (see below for IV to PO recommendations).
- If a gram positive organism is identified that is resistant to other alternatives or if patient allergies limit alternative options, the provider may continue vancomycin.
- If the gram stain or preliminary report on the culture is positive for gram positive cocci in clusters, continue vancomycin for another 24 hours until susceptibilities return.

When should I consider de-escalating vancomycin?

- If culture results show no growth, are negative for the above organisms, and there are no pending gram positive cocci in clusters awaiting speciation, recommend to discontinue the vancomycin if the patient is clinically improving (Assess WBC, hemodynamic status, vitals, temperature and others)
- If no cultures were obtained and the patient is clinically improving, consider discontinuing vancomycin if MRSA is unlikely. Patients with purulent cellulitis or a history of MRSA infection within the last year may be excluded.

Can the patient be switched to an oral antibiotic?

- Criteria to meet before conversion to a PO anti-MRSA agent:
- Patient has an intact and functioning gastrointestinal tract (tolerating oral fluids or enteral nutrition and/or receiving other oral medications).
- Patient is clinically improving and hemodynamically stable (afebrile for at least 24 hours, WBC is trending downward, and not displaying signs of shock).
- Certain infections may exclude patients from IV to PO conversion (e.g. meningitis, endocarditis, bacteremia, intracranial abscess,).

What is the optimal duration of treatment for the infection?

- It is important to consider the duration of therapy once the infection source is known and especially when changing the patient to PO and/or pathogen-directed therapy.
- Patients should receive the minimum effective antibiotic duration required.

Audit & Real-time Feedback/De-escalation: Vancomycin

► Anti-MRSA oral agents:

- ❖ Per indication and clinical response, identify opportunity to switch from intravenous to oral anti-MRSA therapy

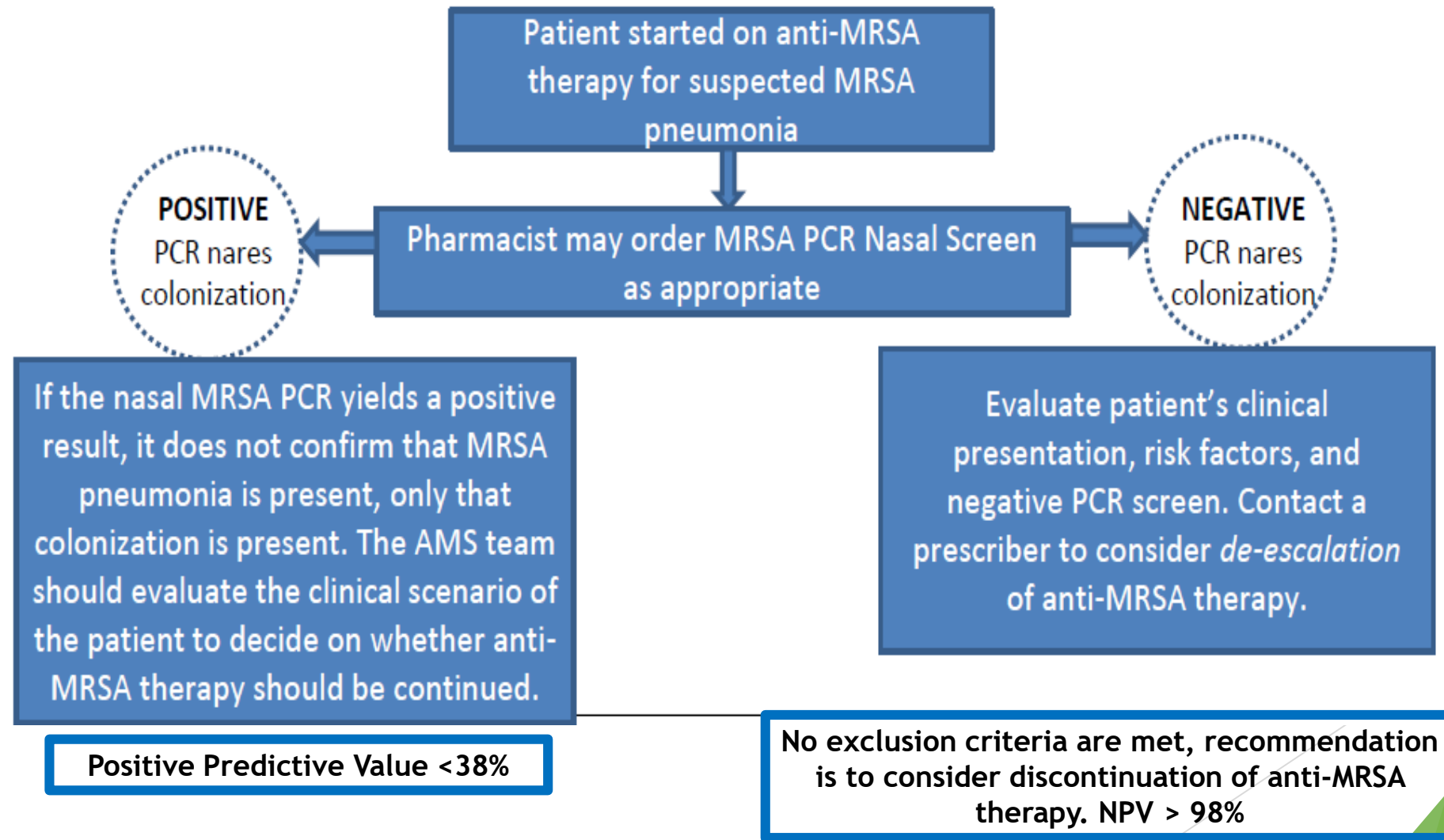
Anti-MRSA Oral Agents by Infection Source (Adults) For Suspected and Confirmed MRSA Infections Guidance Document

*This guidance document excludes staphylococcus aureus bacteremia

Site of Infection	Anti-MRSA Oral options (Ensure susceptibility if organism is isolated)	Clinical Pearls
SSTI^{5,9} Nonpurulent (Cellulitis, Erysipelas) Risk Factors for MRSA (any 1 of the following): -Cellulitis associated with penetrating trauma -History of MRSA infection/colonization -Active injection drug user -Crowded living conditions (e.g. homeless, military, incarceration) -Male with history of having sex with men -Skin infection with poor response to beta lactam antibiotics -Patient report of a "spider bite" Total duration of therapy: Mild: 5 days Moderate: 5-7 days Severe: 7-14 days (duration and IV to PO conversion depend on clinical response) Note: The activity of doxycycline and SMX/TMP against β -hemolytic streptococci is not known, and in the absence of MRSA risk factors (absence of abscess, ulcer, or purulent drainage, β-lactam therapy is recommended. Purulent Skin/Soft Tissue Infection (Furuncle, Carbuncle, Abscess) Mild: I&D alone if no systemic signs and symptoms of infection Moderate: 5-7 days Severe: 7-14 days (duration and IV to PO conversion depend on clinical response)	Trimethoprim (TMP)/ sulfamethoxazole PO 1-2 DS tablets every 12 hours	<ul style="list-style-type: none"> Contraindicated in sulfa allergy, Pregnancy Side effects: Hyperkalemia, acute kidney injury Renal dose adjustment necessary
	Doxycycline PO 100mg every 12 hours	<ul style="list-style-type: none"> Photosensitivity Tissue hyperpigmentation No renal dose adjustments Organisms that are susceptible to tetracycline are also considered susceptible to doxycycline. However, some organisms that are intermediate or resistant to tetracycline may be susceptible to doxycycline¹³
	Clindamycin PO 300-450mg every 6 hours	<ul style="list-style-type: none"> Black Box Warning: <i>Clostridium difficile</i>/colitis No renal dose adjustments <u>Ensure susceptibility prior to use due to frequent resistance among <i>Staphylococcus aureus</i> organisms.</u>

Technology: Rapid Diagnostics/De-escalation

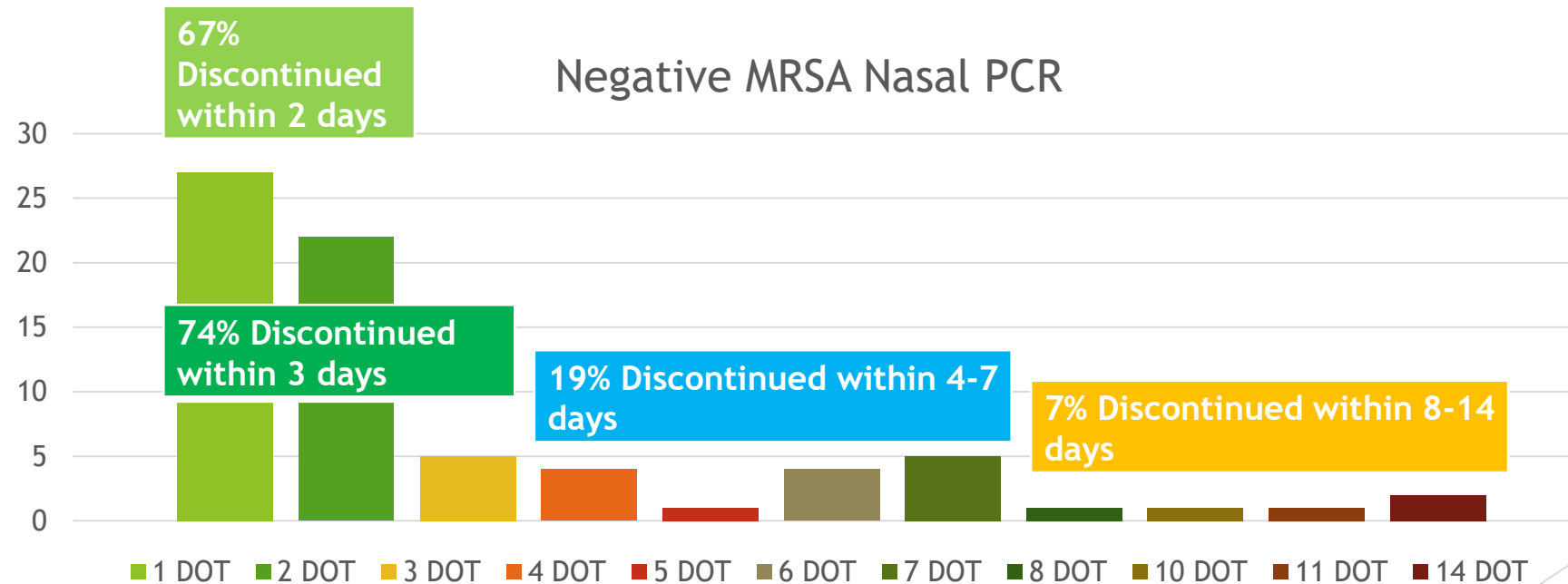
MRSA Nasal PCR Guideline/Recommendation



Negative MRSA Nasal PCR

Duration of Anti-MRSA Therapy (DOT)

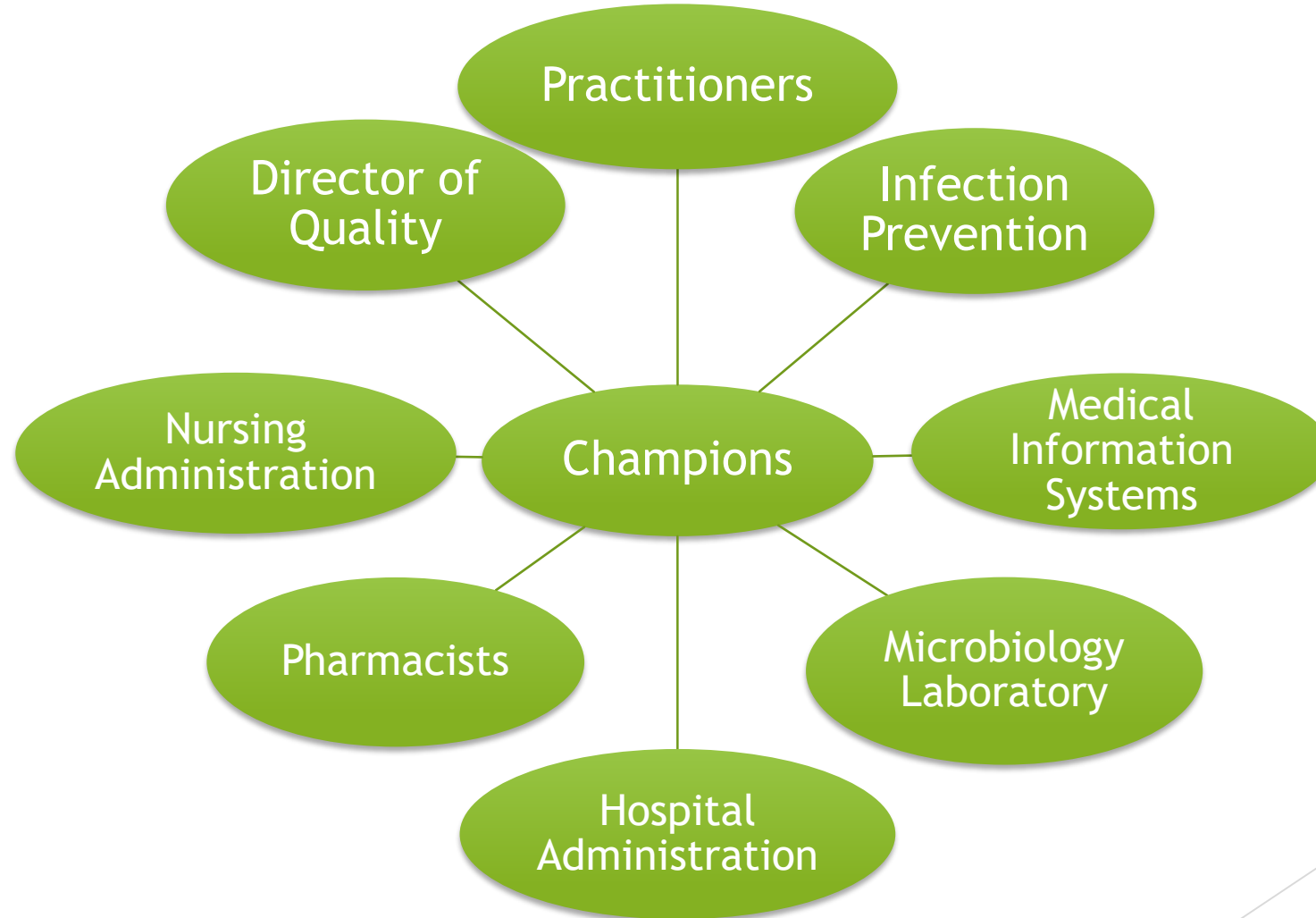
Total # of Negative MRSA Nasal PCR | 73



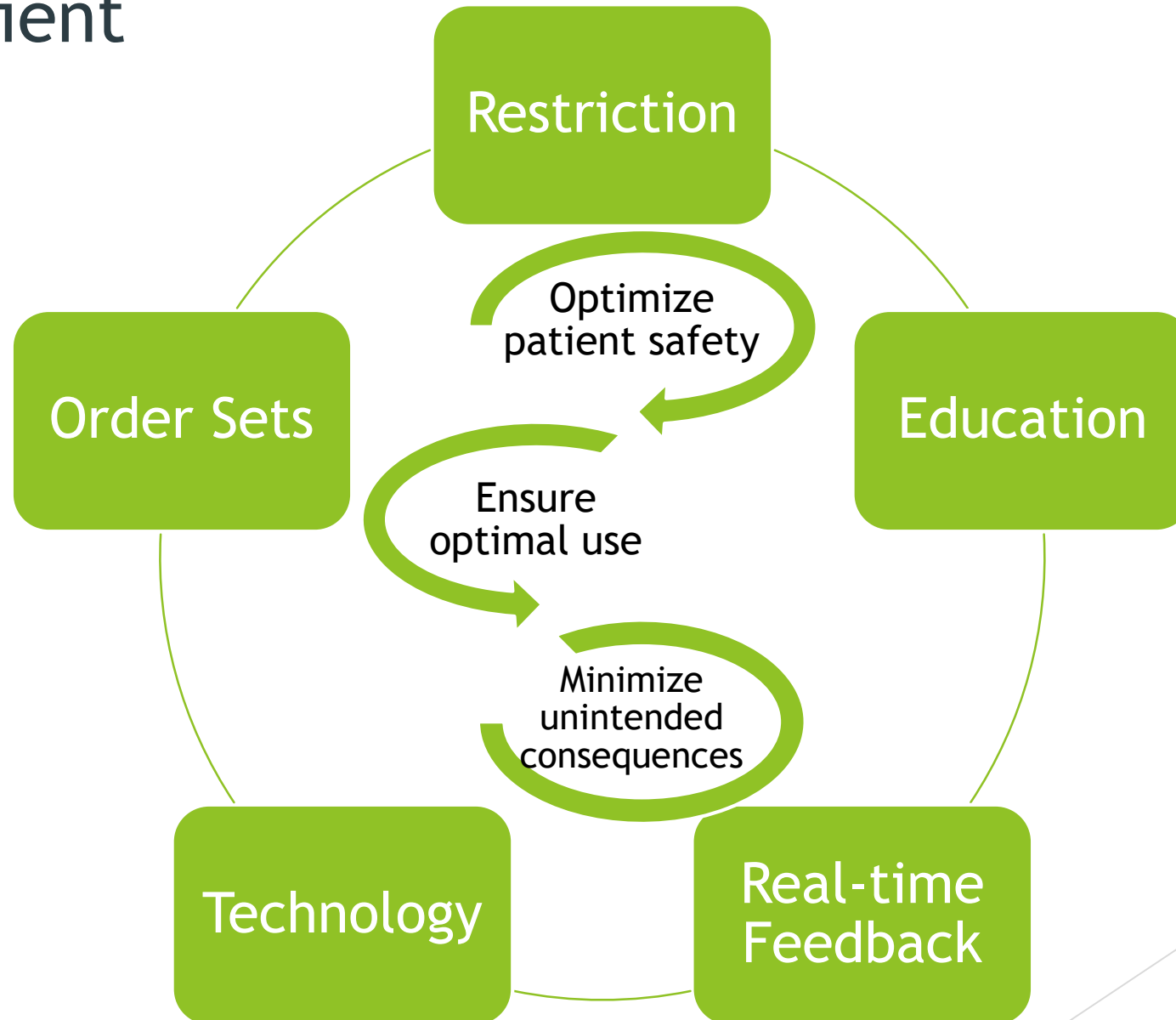
Impact of Real-time Feedback/Technology: Vancomycin

- ▶ Reduce unnecessary use of vancomycin therapy
- ▶ Reduce unnecessary pharmacy, laboratory and nursing resources
- ▶ Reduce unintended consequences and associated toxicity such as acute kidney injury

It takes a team!



Antimicrobial Stewardship Program: Inpatient





Does Antimicrobial Stewardship
apply to hospital setting only?



What about outpatient
Antimicrobial Stewardship?



What about transition of care from
inpatient to outpatient setting?

The Association of Antibiotic Stewardship With Fluoroquinolone Prescribing in Michigan Hospitals: A Multi-hospital Cohort Study

Valerie M. Vaughn,^{1,2} Tejal Gandhi,³ Anna Conlon,¹ Vineet Chopra,^{1,2} Anurag N. Malani^{4,5}, and Scott A. Flanders¹

Methods	<ul style="list-style-type: none">• 48-hospital, retrospective cohort of patients hospitalized with pneumonia or positive urine culture• December 2015–September 2017• Fluoroquinolone exposure was compared between hospitals with and without fluoroquinolone stewardship
Results	<ul style="list-style-type: none">• 11 748 patients (6820 pneumonia; 4928 positive urine culture)• Fluoroquinolone stewardship was associated with fewer patients receiving a fluoroquinolone (37.1% vs 48.2%; $P = .01$) and fewer fluoroquinolone treatment days per 1000 patients (2282 vs 3096 days/1000 patients; $P = .01$), driven by lower inpatient prescribing.• However, most (66.6%) fluoroquinolone treatment days occurred after discharge, and hospitals with fluoroquinolone stewardship had twice as many new fluoroquinolone starts after discharge as hospitals without (15.6% vs 8.4%; $P = .003$).
Conclusion	<ul style="list-style-type: none">• Hospital-based stewardship interventions targeting fluoroquinolone prescribing were associated with less fluoroquinolone prescribing during hospitalization, but not at discharge.• To limit aggregate fluoroquinolone exposure, stewardship programs should target both inpatient and discharge prescribing.

Outpatient Stewardship

Eric Peterson, PharmD

PGY2 Infectious Diseases Pharmacy Resident

Beaumont Hospital - Royal Oak

Transitions of Care (TOC)



Inpatient —————> Outpatient

Common Failings in TOC

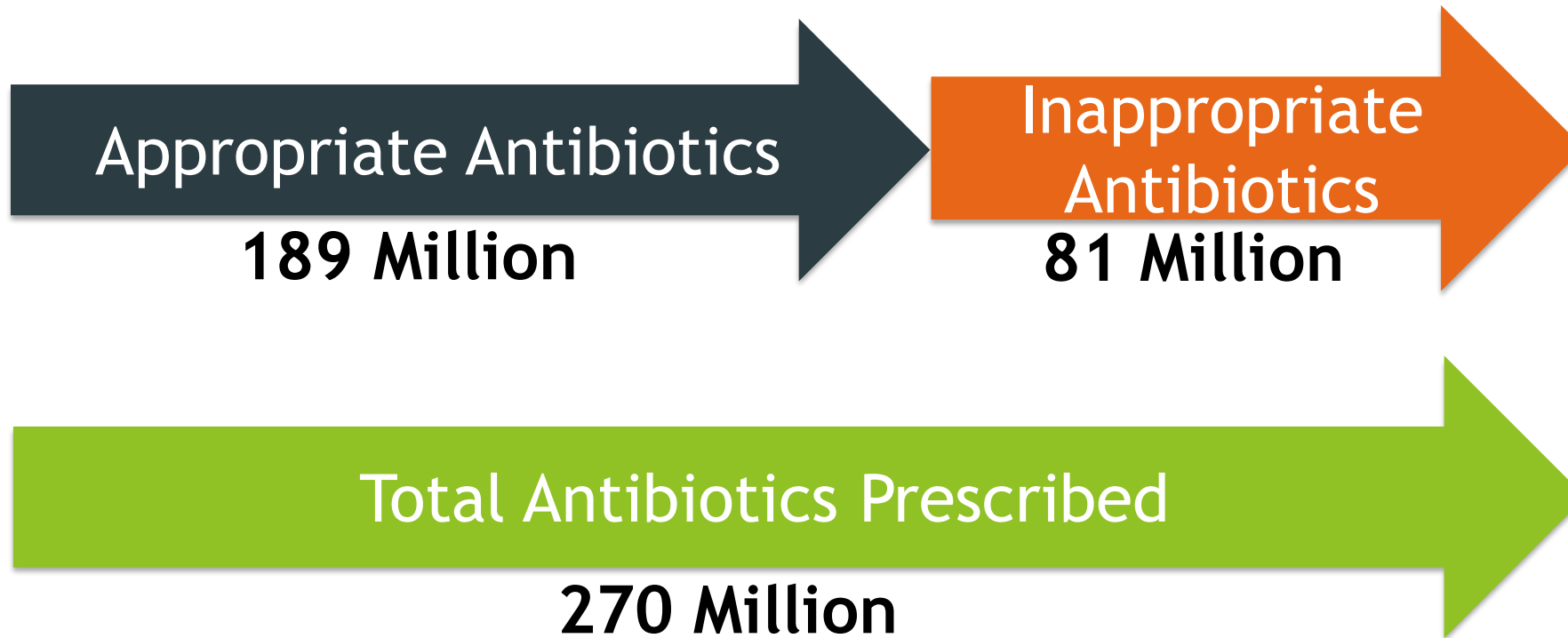
- ▶ Prescribing inadequate doses of oral antibiotics
- ▶ Excessive durations of therapy
 - ❖ It takes time to determine days of adequate therapy inpatient
- ▶ Patient's insurance doesn't cover prescription
 - ❖ Example: fosfomycin, amoxicillin/clavulanate XR



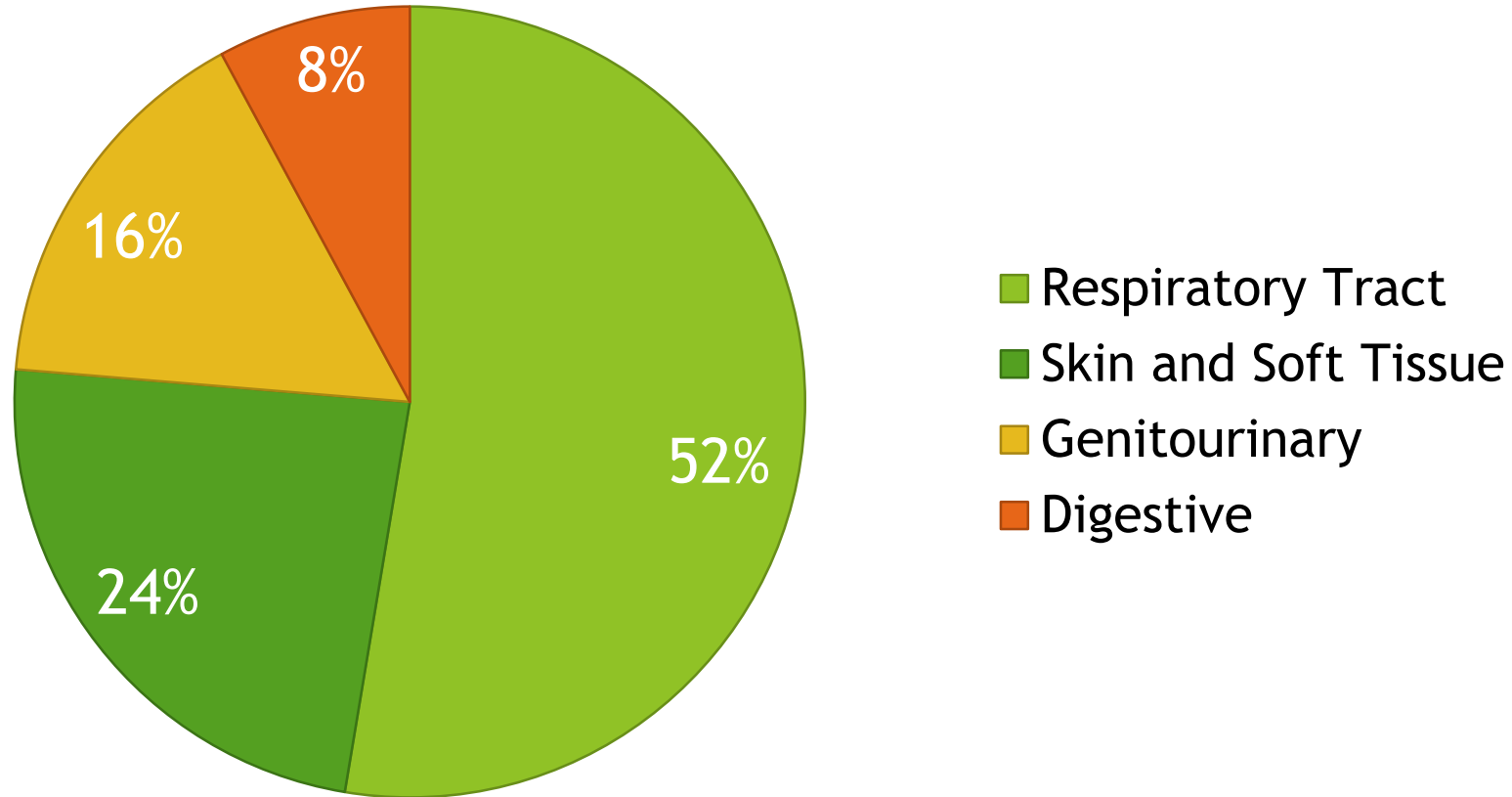
Transitions of Care Antimicrobial Stewardship

- ▶ Some facilities have dedicated TOC staff to perform these responsibilities
- ▶ Multiple strategies exist to improve stewardship in TOC
 - ❖ Pharmacist driven medication review prior to discharge
 - ❖ Culture review process for patients discharged from the hospital
 - ❖ Evaluating appropriateness of outpatient parenteral antibiotic therapy (OPAT)
- ▶ Successful implementation can ease transition to the outpatient setting

Outpatient Antibiotic Prescriptions: 2016



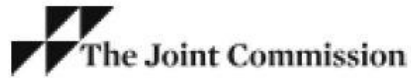
Outpatient Antibiotic Indications



Why is Outpatient Stewardship Needed

- ▶ Vast majority of antibiotics are prescribed in the outpatient setting
 - ❖ Little oversight on prescribing appropriateness
- ▶ Rates of resistance in the community are rising
 - ❖ Community-acquired methicillin resistant *Staphylococcus aureus* (CA-MRSA)
 - ❖ Extended-spectrum beta-lactamase (ESBL) organisms
- ▶ Rates of inappropriate prescribing are high
 - ❖ Estimated at 30% for all antibiotic prescribing
 - ❖ Up to 50% for acute respiratory tract infections

Joint Commission Ambulatory Requirements



Proposed New Requirements for Antimicrobial Stewardship

Ambulatory Health Care Accreditation Program

MM.09.01.03

- 1 Antimicrobial stewardship is identified as an organizational priority.

Elements of Performance (EPs) for MM.09.01.03

- 2 1. The organization identifies an individual(s) responsible for developing, implementing, and monitoring
3 activities to promote appropriate antimicrobial medication prescribing practices.
- 4 2. The organization sets at least one annual antimicrobial stewardship goal.
5 Note: Examples of antimicrobial stewardship goals include decreasing the use of antibiotics to treat viral
6 infections or addressing overuse of a specific medication.

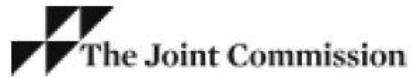
Joint Commission Ambulatory Requirements

1. The organization identifies an individual(s) responsible for developing, implementing, and monitoring activities to promote appropriate antimicrobial medication prescribing practices
2. The organization sets at least one annual antimicrobial stewardship goal
3. The organization uses approved protocols and evidence-based practice guidelines related to its annual antimicrobial stewardship goal(s)

Joint Commission Ambulatory Requirements

4. The organization provides all clinical staff and licensed independent practitioners with educational resources related to its antimicrobial stewardship goal(s) and strategies that promote appropriate antimicrobial medication prescribing practices
5. When the patient's care, treatment, or services are related to an annual antimicrobial stewardship goal, the organization educates the patient, and the family as needed, about appropriate prescribing of antimicrobial medications, potential adverse drug events from antimicrobial medications, importance of treatment adherence, and symptom management and duration
6. The organization collects, analyzes, and reports data pertaining to the antimicrobial stewardship goal(s) to organizational leadership

Joint Commission Ambulatory Requirements



Proposed New Requirements for Antimicrobial Stewardship

Ambulatory Health Care Accreditation Program

MM.09.01.03

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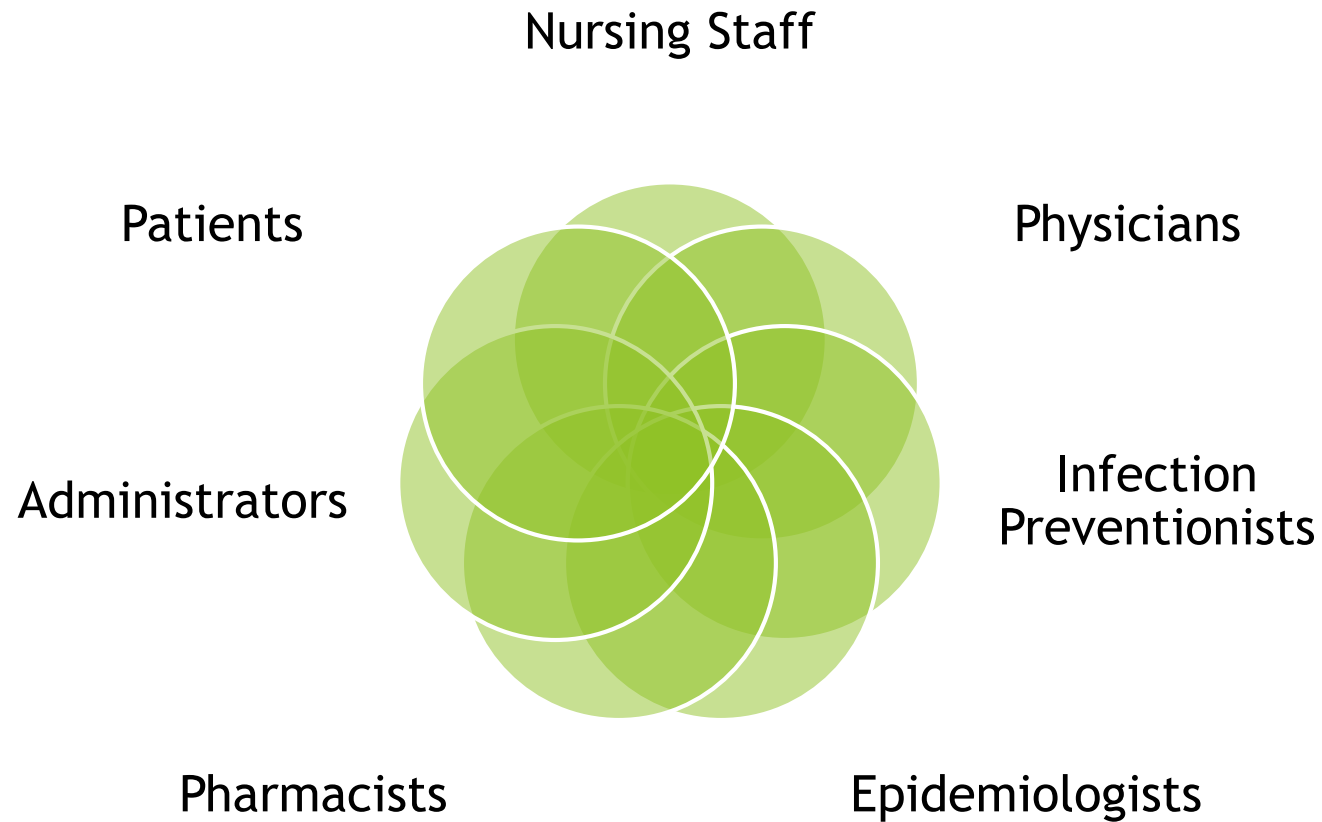
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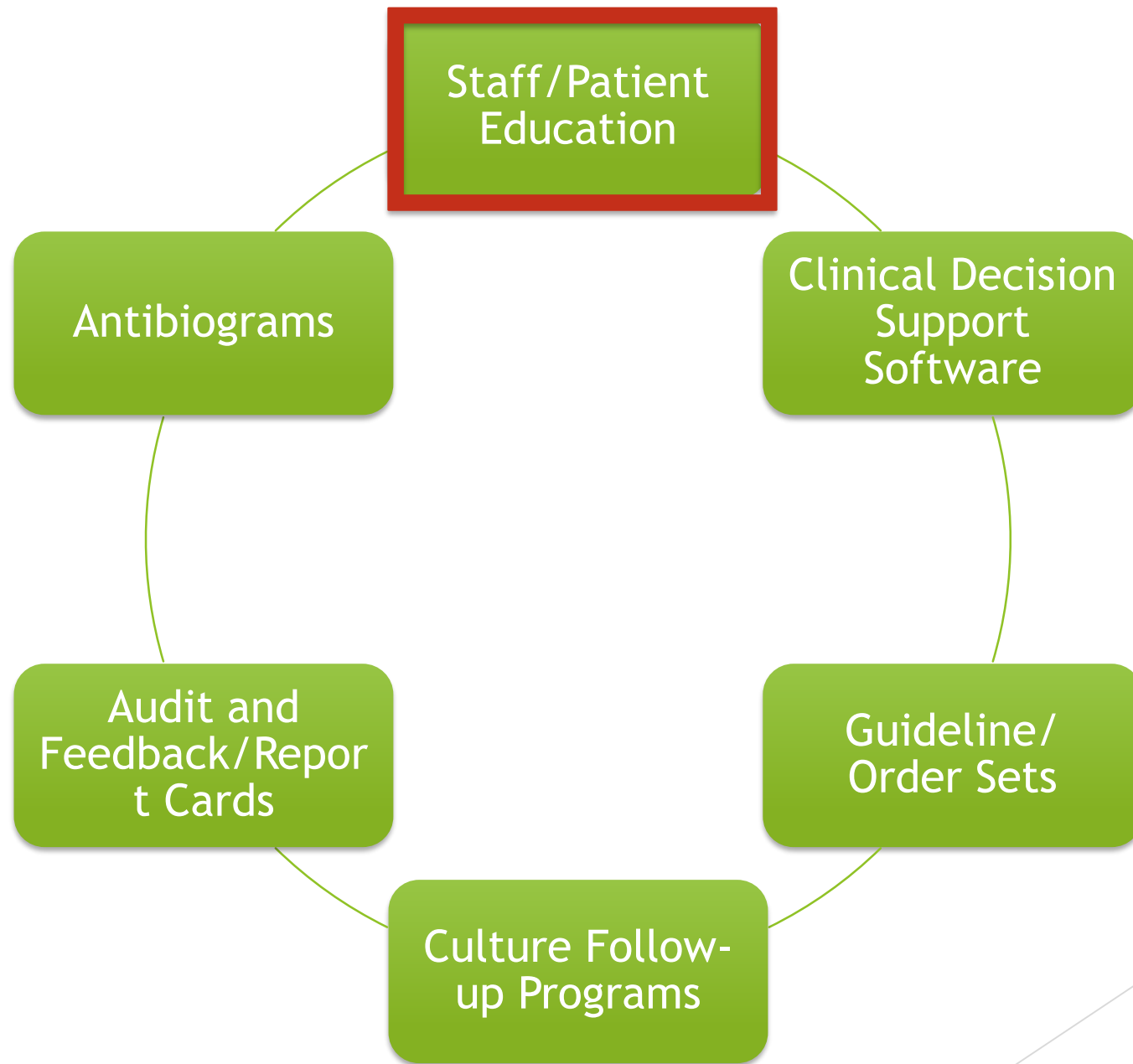
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Outpatient Stewardship

- ▶ Outpatient stewardship can be considered in many areas:
 - ❖ Outpatient clinics
 - ❑ Medical group practices
 - ❑ Telehealth
 - ❑ Correction health centers
 - ❖ Immediate care facilities
 - ❑ Emergency departments
 - ❑ Urgent care
 - ❖ Office-based surgery

Antimicrobial Stewardship Team





Education

- ▶ Can be provided by nurses, pharmacists, and physicians
- ▶ Frequency can vary widely
- ▶ Most common targets include physicians and patients
- ▶ Impact varies
- ▶ Commonly combined with other initiatives

Clinician Education

Study Design	Randomized trial evaluating outpatient clinics within a United Kingdom health system
Intervention	Clinics received education focusing on: antimicrobial resistance, treatment guidelines, and motivational interviewing skills
Outcome	An overall reduction in antibiotic prescribing was observed ranging from 2% to 9% based on which antibiotic was evaluated. Overall antibiotic prescribing was reduced by 4.2%
Conclusions	Educational interventions can result in decreases in antibiotic use in the outpatient setting and should be considered by outpatient stewardship programs
Applicability	Very broad intervention. For smaller programs would be better to focus on specific infection types or antibiotics

Patient Education

- ▶ Patient education can be beneficial to reduce antibiotic use due to patient's perceptions of needing antibiotic therapy
 - ❖ This can put pressure on clinicians to prescribe antibiotics
- ▶ “CDC Get Smart: Know When Antibiotics Work”
 - ❖ Resource for both patients and healthcare providers
 - ❖ Contains printable resources to have in clinic

<http://www.cdc.gov/getsmart/community/index.html>

ANTIBIOTICS AREN'T ALWAYS THE ANSWER.



Antibiotics save lives. Improving the way healthcare professionals prescribe antibiotics, and the way we take antibiotics, helps keep us healthy now, helps fight antibiotic resistance, and ensures that these life-saving drugs will be available for future generations.



The Facts:

When a patient needs antibiotics, the benefits outweigh the risks of side effects or antibiotic resistance.

When antibiotics aren't needed, they won't help you, and the side effects could still hurt you.

Common side effects of antibiotics can include rash, dizziness, nausea, diarrhea, or yeast infections. More serious side effects include *Clostridium difficile* infection (also called *C. difficile* or *C. diff*), which causes diarrhea that can lead to severe colon damage and death. People can also have severe and life-threatening allergic reactions.

Antibiotics do not work on viruses, such as colds and flu, or runny noses, even if the mucus is thick, yellow, or green.

Antibiotics are only needed for treating certain infections caused by bacteria. Antibiotics also won't help for some common bacterial infections including most cases of bronchitis, many sinus infections, and some ear infections.

Taking antibiotics creates resistant bacteria. Antibiotic resistance occurs when bacteria no longer respond to the drugs designed to kill them.

Each year in the United States, at least **2 million** people get infected with antibiotic-resistant bacteria. At least **23,000** people die as a result.

If you need antibiotics, take them exactly as prescribed. Talk with your doctor if you have any questions about your antibiotics, or if you develop any side effects, especially diarrhea, since that could be a *C. difficile* (*C. diff*) infection which needs to be treated.

Reactions from antibiotics cause 1 out of 5 medication-related visits to the emergency department. In children, reactions from antibiotics are the most common cause of medication-related emergency department visits.

<http://www.cdc.gov/getsmart/community/index.html>

Viruses or Bacteria

What's got you sick?

Antibiotics are only needed for treating certain infections caused by bacteria. Viral illnesses cannot be treated with antibiotics. When an antibiotic is not prescribed, ask your healthcare professional for tips on how to relieve symptoms and feel better.

Common Condition	Common Cause			Are Antibiotics Needed?
	Bacteria	Bacteria or Virus	Virus	
Strep throat	✓			Yes
Whooping cough	✓			Yes
Urinary tract infection	✓			Yes
Sinus infection		✓		Maybe
Middle ear infection		✓		Maybe
Bronchitis/chest cold (in otherwise healthy children and adults)*		✓		No*
Common cold/runny nose			✓	No
Sore throat (except strep)			✓	No
Flu			✓	No

* Studies show that in otherwise healthy children and adults, antibiotics for bronchitis won't help you feel better.



To learn more about antibiotic prescribing and use, visit www.cdc.gov/antibiotic-use.



“Antibiotics will not treat acute bronchitis”

Recommended Treatment

Good news! Acute bronchitis almost always gets better on its own—without antibiotics. Using antibiotics when they aren’t needed can do more harm than good. Unintended consequences of antibiotics include side effects, like rash and diarrhea, as well as more serious consequences, such as an increased risk for an antibiotic-resistant infection or *Clostridium difficile* infection, a sometimes deadly diarrhea.

To Feel Better:

- ◆ Get plenty of rest
- ◆ Drink plenty of fluids
- ◆ Use a clean humidifier or cool mist vaporizer
- ◆ Breathe in steam from a bowl of hot water or shower
- ◆ Use lozenges (*do not give lozenges to children younger than 4 years of age*)
- ◆ Ask your healthcare professional or pharmacist about over-the-counter medicines that can help you feel better

Remember, always use over-the-counter medicines as directed for cough and cold medicines in children younger than 4 years unless specifically told to do so by a healthcare professional.

Your healthcare professional will most likely prescribe antibiotics for a diagnosis of whooping cough (pertussis) or pneumonia.

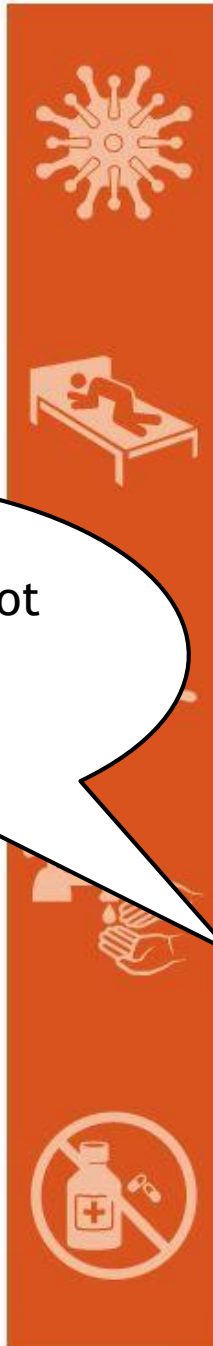
Prevention

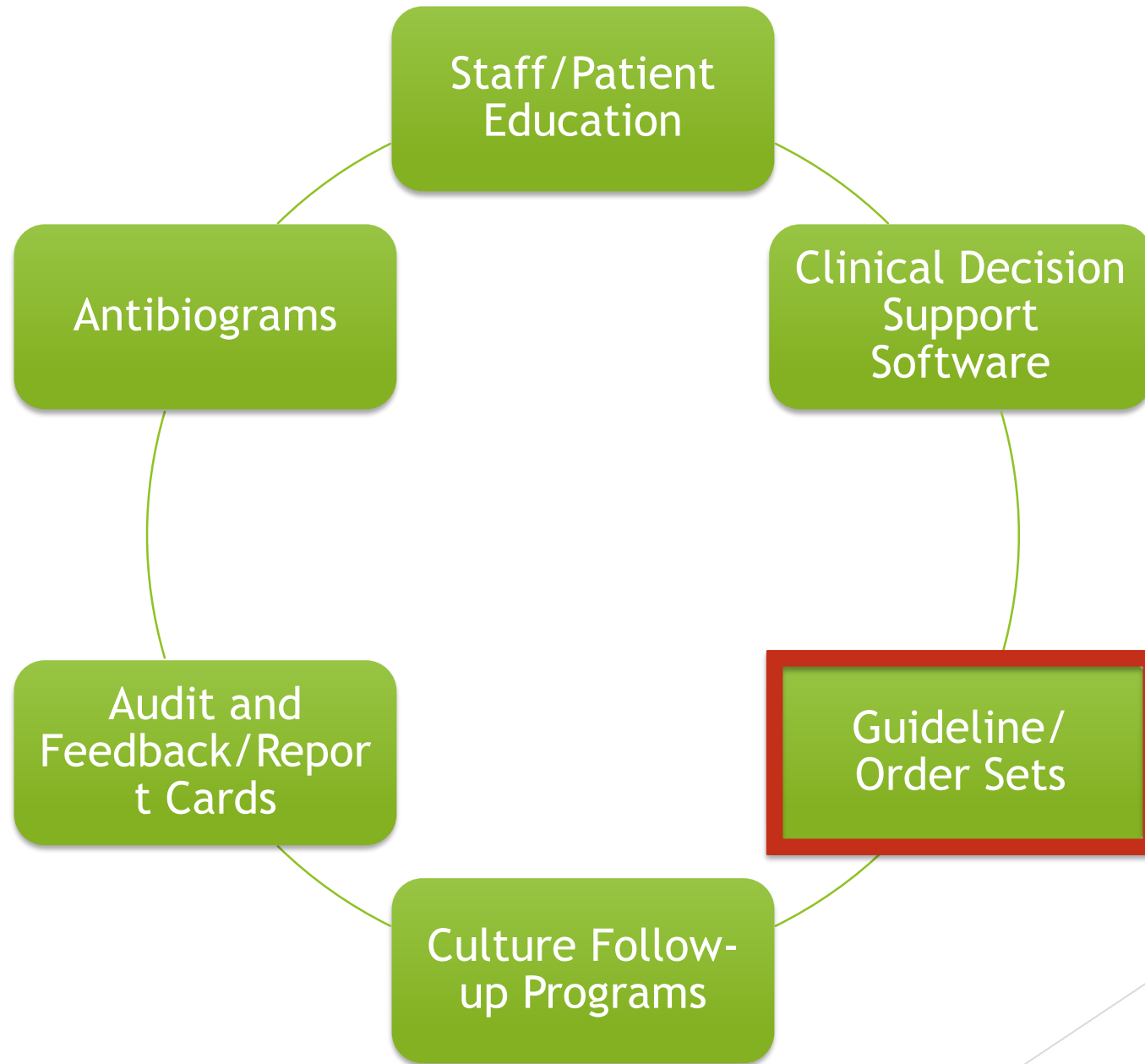
- ◆ Practice good hand hygiene
- ◆ Make sure you and your child are up-to-date with all recommended vaccinations
- ◆ Don’t smoke and avoid secondhand smoke, chemicals, dust, or air pollution
- ◆ Always cover your mouth and nose when coughing or sneezing
- ◆ Keep your distance from others when you are sick, if possible

And Remember:

Antibiotics will not treat acute bronchitis. Using antibiotics when not needed could do more harm than good.

“Antibiotics can do more harm than good”





Order Set Benefits

► Advantages of order sets for stewardship include:

- ❖ Improved adherence to national guidelines
- ❖ Targets antibiotic selection
- ❖ Can be customized based on need

► Limitations of order sets include:

- ❖ Use is not mandatory
- ❖ Limited awareness will limit utility
- ❖ Requires periodic updating

Example Order Set Intervention

► Beaumont Adult Outpatient Clinic



Intervention

- ▶ Monthly education was provided to residents staffing the clinic
 - ❖ Focused on etiology, diagnosis, and treatment of acute respiratory tract infection (ARTI)
 - ❖ Educated on order set implementation and encouraged use
- ▶ Order sets were incorporated into electronic medical record (EMR) for various ARTI providing recommends for:
 - ❖ Diagnosis
 - ❖ Antibiotic selection (if indicated)
 - ❖ Supportive care measures

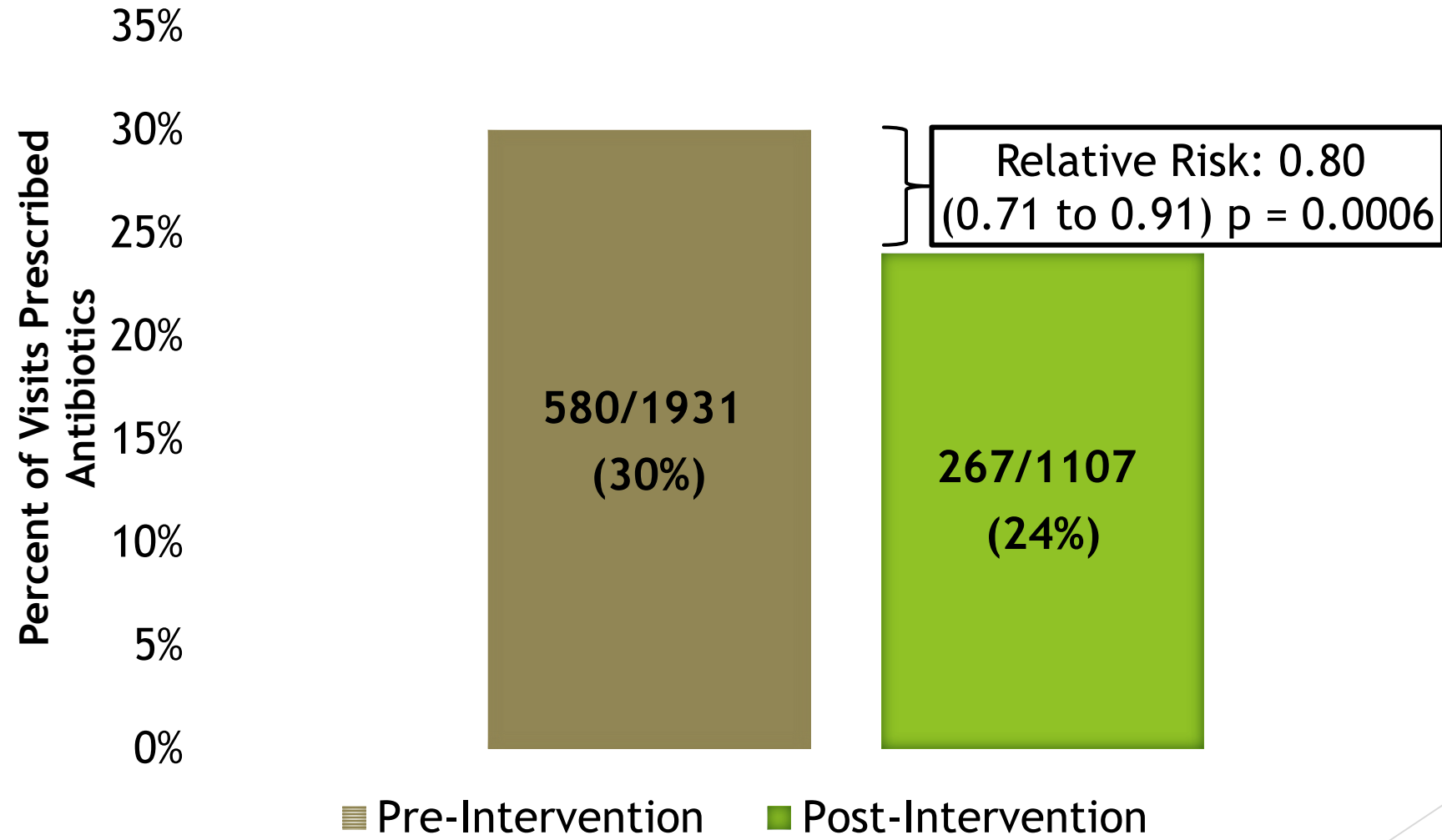
Primary Outcome: Percent of clinic visits prescribed antibiotics for bronchitis, pharyngitis, sinusitis, and unspecified respiratory infections as a composite

Order Set Example

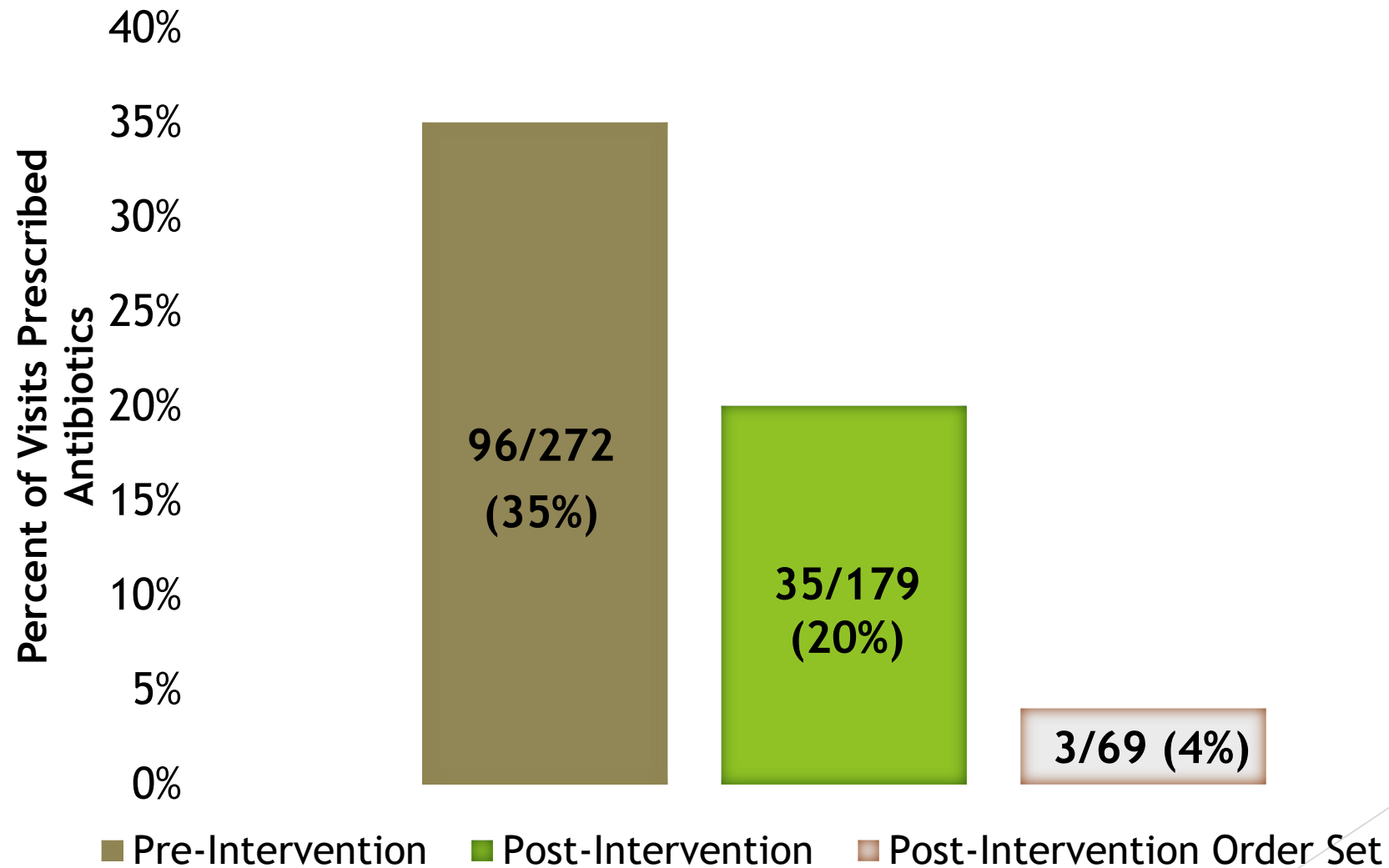
Acute Bronchitis

- ▶ Diagnostic
 - ❖ Rapid influenza/RSV by PCR
 - ❖ Chest X-ray
- ▶ Supportive Care
 - ❖ Benzonatate
 - ❖ Albuterol HFA
- ▶ Antibiotics not indicated for the treatment of bronchitis

Antibiotic Prescribing Frequency: Composite

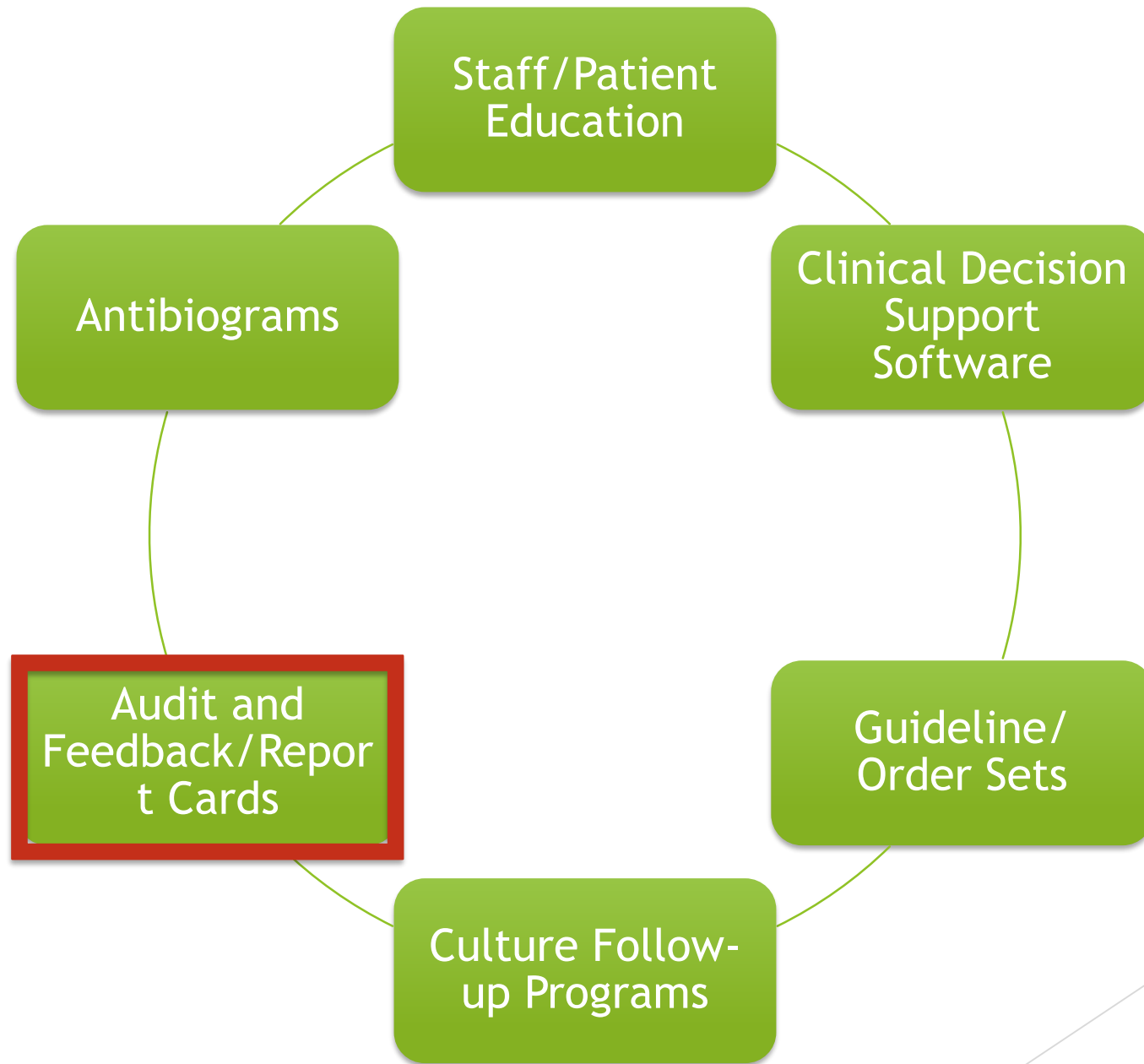


Antibiotic Prescribing Frequency: Bronchitis



Study Conclusions

- ▶ Order sets and monthly provider education can reduce the rate of outpatient antibiotic prescribing for ARTIs and improve antibiotic appropriateness
- ▶ The largest effects on antibiotic prescribing and antibiotic appropriateness were seen in bronchitis
- ▶ More evaluation needs to be done evaluating the effect of order sets on antibiotic days of therapy, hospitalization rate, and development of *Clostridioides difficile* when used for ARTI

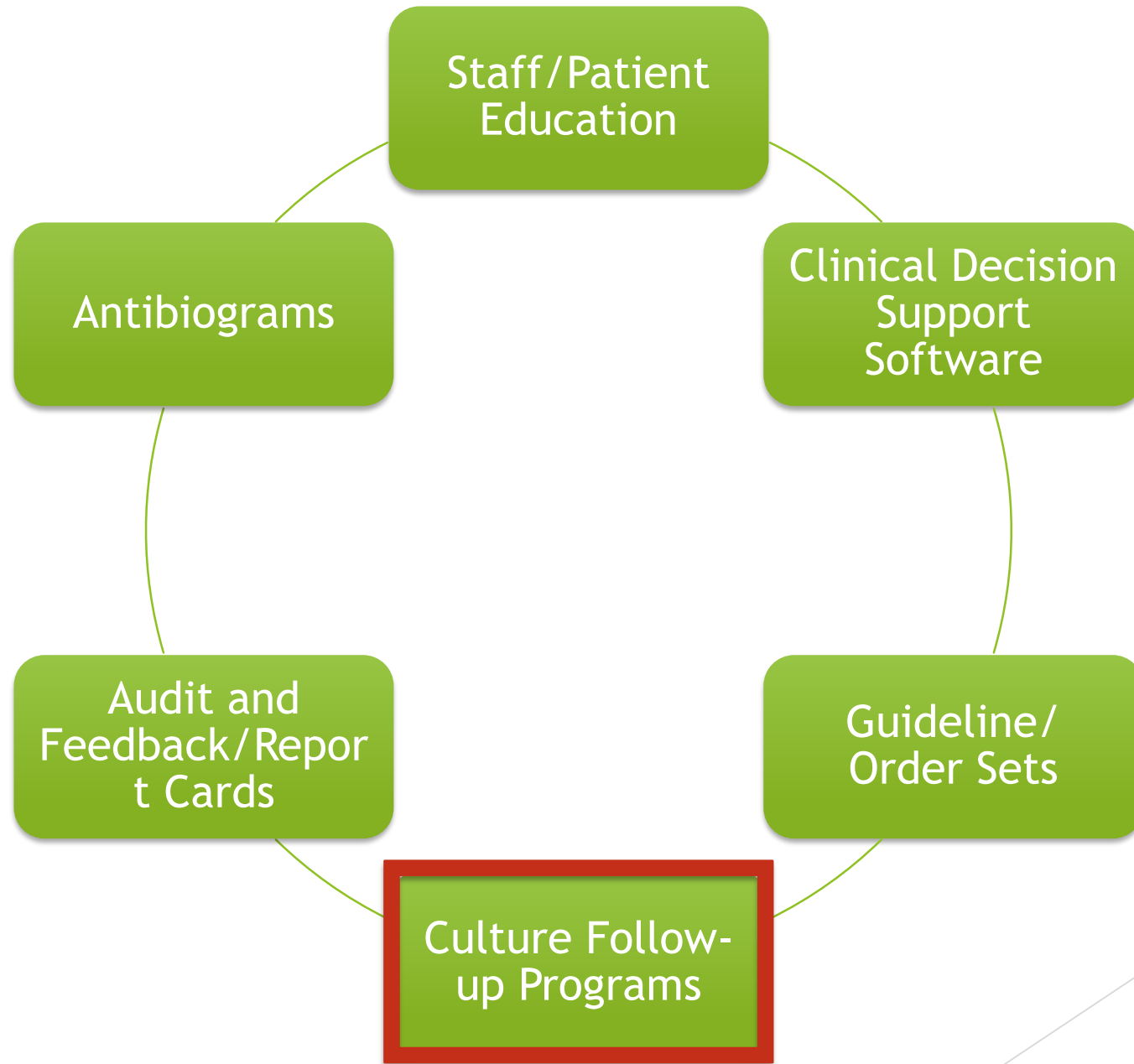


Audit and Feedback/Report Cards

- ▶ Periodic evaluation and reporting of antibiotic prescribing metrics can be used to influence appropriate prescribing
- ▶ Can be reported for individual prescribers or to clinics as a whole
- ▶ Often coupled with other interventions to demonstrate results

Audit and Feedback

Study Design	Cluster randomized trial evaluating changes in inappropriate antibiotic prescribing over time for ARTIs at pediatric clinics
Intervention	One hour educational session focusing on prescribing guidelines. This was combined with quarterly feedback reports on antibiotic prescribing for ARTIs
Outcome	After 12 months, broad-spectrum antibiotic prescribing decreased from 26.8% to 14.3%
Conclusions	Outpatient antibiotic stewardship consisting of education and quarterly audit and feedback can effectively reduce antibiotic prescribing for ARTI in pediatrics
Applicability	Can be incorporated into different settings including adult clinics. Using standard metrics, the data is relatively accessible depending on EMR



Culture Follow-Up Programs

- ▶ Unfortunately culture results are often not followed up on in emergency/urgent care settings
- ▶ This can lead to unnecessary visits back to the ED

Culture Taken

+

Culture Results

=



Culture Review Process

Study Design	Retrospective descriptive study of pharmacist driven urine culture follow-up program that was expanded from ED to include 2 urgent care locations
Intervention	Pharmacists evaluated positive cultures for patients discharged from urgent care and tracked interventions made under a collaborative practice agreement
Outcome	A total of 1461 culture results were evaluated over a 12-month period. Of those, 320 (22%) required an intervention including a new antibiotic or counseling
Conclusions	Urgent cares frequently have little antibiotic stewardship oversight and may benefit from the addition of a culture review process that is operated by ED pharmacists and residents
Applicability	In settings that currently have an ED culture review process, the addition of urgent cares may be feasible depending on current workload of culture follow-up team

Implementing Interventions

- ▶ Utilize available resources:
 - ❖ A Field Guide to Antibiotic Stewardship in Outpatient Settings - Centers for Medicare and Medicaid Services
 - ❖ Antibiotic Prescribing and Use in Doctor's Offices - Centers for Disease Control and Prevention (CDC)
 - ❖ Core Elements of Outpatient Stewardship - CDC
- ▶ Choose interventions that have been shown to be effective and are applicable to the site
- ▶ Combining multiple interventions is a common practice
- ▶ Always track results!

Challenges to Outpatient Stewardship

- ▶ Because clinics and urgent cares are so numerous, this can make it challenging to reach everyone
- ▶ Funding for stewardship positions limited
- ▶ Clinics have different EMRs, patient populations, workflow
- ▶ Data can be difficult to access depending on IT support and EMR being used

Conclusions

- ▶ There are multiple ways to address antimicrobial stewardship in the outpatient setting including education, order set modification, audit and feedback reports and culture follow-up programs
- ▶ Multi-modal approaches are recommended to optimize antibiotic prescribing
- ▶ Interventions should be customized to patient populations, clinic vs urgent care, and local prescribing practices
- ▶ Always track and report the success of the intervention

Outpatient Stewardship

Eric Peterson, PharmD

PGY2 Infectious Diseases Pharmacy Resident

Beaumont Hospital - Royal Oak

Contact: Eric.Peterson@Beaumont.org